BOYNTON

BICYCLE RAILW

SY

OFFICE:
32 NASSAU STREET, ROOM 615, NEW YORK.

EBEN MOODY BO
DR. JAMES B. BI
D. C. REUSCH, S

A Bicycle Electric Car in Practical Operation at Bellport, L. I.
Has been run 7,500 miles. Weight, complete, 6 tons. Rate of speed attained on 1½ miles of track, 60 miles per hour. Highest speed on 8° curve.

Interior of Electric Motor Car " Rocket," at Bellport, L. I., on Long Island Boynton Bicycle R. R.

THE

BOYNTON BICYCLE RAILWAY SYSTEM.

THE thirty pound bicycle has safely carried ten times its weight. A man has in one day propelled himself and his machine *five hundred and fifteen miles.* The principle of the bicycle, saving enormously in weight and friction, is here presented for application to existing and to future steam and electric roads without change of gauge or interference with existing trains.

Turn a plank up edge-wise and it will carry many-fold greater load than it would flat-wise: so by constructing two-story cars, about four feet wide and fourteen feet deep, greatly increased strength and lightness may be secured.

The cellular construction of the bamboo makes it extremely light and yet strong; so it is with the Bicycle car, constructed with veneer and steel, and composed of eighteen separate compartments corresponding to the cells of the bamboo.

It is the aim of this invention to reduce the undulations and friction of a car in motion, thereby largely increasing safety and speed, and saving wear and tear on both rolling stock and track.

Engines are now required to drive from four to eight wheels held in line back of the cylinders. On rounding curves the framing is strained by friction and wedging, entailing a large loss of power. The wheels, rails, and cars

throughout suffer proportionately from grinding and shearing. The Bicycle engine, with its double-flanged wheels, follows any curve with a small loss of power.

One or more driving-wheels running on a single rail is the simplest of all means of transportation ; so manifest is it that the U. S. Patent Examiner, in charge of the railroad department, writing to the Hon. E. M. Boynton, the inventor, calls it "a practical solution of the problem of increased rate of speed—simple, inexpensive, practical."

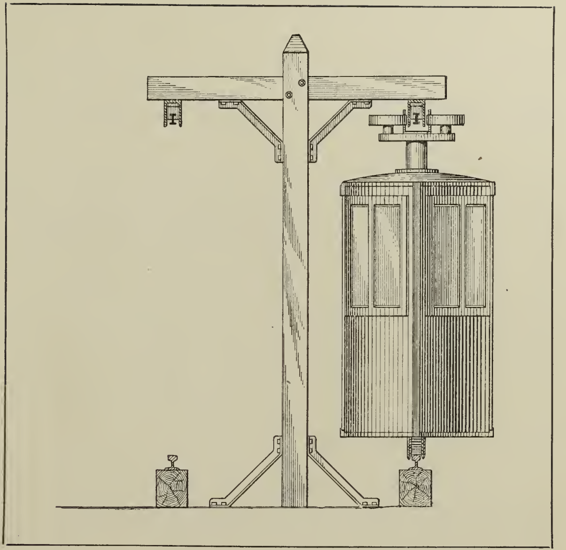
A driving-wheel six feet in diameter can doubtless be made to run a Bicycle locomotive one hundred to one hundred and twenty miles an hour, with short stroke engines, and double the number of revolutions they now make, its speed being limited only by friction and air pressure. Ninety miles an hour, however, would probably for the present satisfy all reasonable wants for express trains, and a proportionately lower rate of speed for local and freight trains.

The overhead guiding beam is set inward, on curves, tipping the train toward the center of the curve, thus counteracting the centrifugal force, like a bicycle.

Practice has demonstrated that the twenty-two ton Bicycle locomotive is so truly balanced, that when running on a tangent, the upper horizontal bearing-wheels seldom touch the overhead guide beam, an inch space being left between them ; and it is found that even when running on curves, at high rates of speed, as the train is made to lean inward to balance the centrifugal force, the friction of the overhead or guiding-wheels is but trifling.

The *Engineering News* of March 2, 1889, says :

"That the motion of a train running on a single rail in this manner might be very much smoother and safer, seems to us reasonable, or at least a chance worth thorough investigation. It is a wholly different matter from narrowing the gauge. So long as the reliance for stability is on the support of a pair of rails (the center of gravity falling between them), all narrowing of gauge must be a disadvantage ; and as it is impossible to maintain a pair of rails exactly horizontal, there must inevitably be a jerking of the train from side to side, which, at high speed, becomes exceedingly dangerous ; because, whenever the level is not perfect, there is a tendency created to lateral impact against one rail or the other. In bicycle motion all this tendency is eliminated. There is nothing but the forward motion to maintain perpendicularity in the vehicles (except when the top guard-rail comes by accident into action), nor is anything more needed. Hence there is only the vertical irregularities of the rail to be taken into account ; and even if they should cause considerable bouncing at points, it is directly up and down, without tendency to cause lateral motion, the center of gravity being directly over the point of support tending, unaided, to stay there.* Taking into account this great potential advantage and



Cross Section of Bicycle Structure and Bicycle Electric Car.

the smaller cross-section of the train, it appears reasonable that a much higher rate of speed may be safely maintained than is either possible or safe with double-rail vehicles."

Comparing weight to work done, about one ton of train weight is now required to convey a passenger, and the average freight train, empty, weighs more than the paying freight carried by it; whereas it is practicable for the Bicycle trains to be made to carry more than five times their own weight without five-fold loss of wasteful friction, thus affecting a saving of at least ten-fold in freight, and twenty-fold on passenger trains. The Bicycle cars already built, seat 108 passengers, and weigh complete only five tons.

* The writer has had several opportunities of riding on the standard gauge locomotives, and noticed, in rounding curves, even at the rate of thirty-five miles per hour, the resulting zig-zag motion; the machine would be running on the tread of the wheels as far as the flanges allowed to one side, striking with terrible force, then bounding to the other side and repeating the action again and again, until it seemed impossible that the rails could be held in place with spikes firmly enough to prevent their tipping over or spreading.

ADVANTAGES OF THE BICYCLE SYSTEM.

THE peculiar construction of the two-story Bicycle cars, four feet wide, fourteen feet deep, and forty-two feet long, shaped like a plank turned edge-wise, makes them many fold lighter and stronger.

Speed and economy of transportation with reduced cost of construction.

A great saving of expense in grading and land damages.

A greater proportion of paying to non-paying load by the use of narrow two-story deep cars.

A great reduction in cost and wear of rolling stock.

A large saving of friction in rounding curves by the substitution of Bicycle spindles for ordinary car wheel axles, and consequent economy of power in moving trains, and a rate of speed more than double that heretofore obtained on railways, with comfort to passengers, and economy in the conveyance of freight.

Greater safety; as a train grooved between an upper support and lower rail renders any derailment impossible, and the train must run true, smooth and safe.

Spreading of rails by this system will be entirely unknown, the weight being centralized on the rail, both on a curve and a tangent.

A many-fold saving in the consumption of fuel, as the weight of cars drawn would be about one-sixth the weight of the ordinary cars, and the seating capacity double.

The two-story cars of this system are 14 feet in depth, 42 feet long, leaving 6½ feet in the clear for each series of compartments, and are reached in loading and unloading by two-story platforms in the depots and spiral staircases at the end of such cars as may be thought desirable on through trains. The material of which the car is constructed is wood veneer, held in place by steel bands and rods. The cars now in use have nine compartments below and nine above, each room having seating capacity for six people, face to face, seated as in a hack, 108 seats in a car. This cellular construction, like the bamboo, insures great strength and lightness. A

triple band of steel encircles the car lengthwise. At the top, center and bottom, ten bands of steel encircle the car vertically opposite each division wall of the compartment, which practically divides the car from top to bottom. Eighty-eight steel rods run through between the seats across the car, the ends being in the steel frame, and thus draw the whole solidly together. The corners of the car, being covered with steel, are protected, and the strength and lightness are unsurpassed. Thus one hundred pounds is made to do the work which requires ten hundred to thirty hundred pounds in the old-fashioned heavy two-rail car.

There are eighteen doors on each side of the car, making thirty-six in all.

The veneer of which the car is constructed is three thicknesses of one-eighth of an inch each, with grain of inner layer running opposite to that of outer layers. The seats are of thin veneer running across the car, two in each compartment. This car will seat 108 persons and weighs a little less than five tons.

At the top of the car, as shown in illustration on page 9, are the bolsters holding the trolley wheels which support it in an upright position. On each end, and supporting the car, are trucks which swivel the same as ordinary car trucks, and are supplied with wheels forty inches in diameter. These wheels are constructed of the best quality of steel, light and yet very strong. Spiral springs are used in cushioning the motion of the car, and are placed in the bolster directly under the center of the car.

MOTION OF THE BICYCLE CAR AS COMPARED WITH STANDARD GAUGE CARS.

THE spiral springs placed in the center of the Bicycle car allow only a vertical motion, whereas the ordinary standard gauge cars, from their width and the arrangement of their springs, allow an extreme swaying motion, which in a long journey becomes very trying, and to a great many persons is the cause of "sea-sickness."

When a Bicycle car is rounding even very sharp curves, and at a rapid rate of speed, the swaying motion or tendency to throw the occupant laterally, is very slight and can scarcely be felt. The reason for this is obvious, as the Bicycle car is held rigidly, so far as any lateral motion is concerned, but tilts naturally to the right or left according to the direction of the curve.

With these cars it has also been found, that the greater the speed the smoother they run, providing the rail itself, upon which the cars run, is true. But supposing for the sake of argument that the rail is not smooth or true, even the uninitiated can readily see, that the Bicycle car having only half the number of wheels, meets only one-half the inequalities of the rail, and wherever these occur, cause only a vertical motion, whereas the standard gauge cars have both the lateral and vertical motion, in consequence of being let down first on one side and then on the other.

As we have already shown, the Bicycle car is absolutely controlled by the overhead structure, both from any tendency to bound or leave the track in any possible manner; in fact by its momentum it is also self supported, like the bicycle, causing only a slight strain on the structure, even when maintaining a high rate of speed. This being a fact it can readily be seen that the side motion of the car could not in any case be great, and a speed of even 100 miles an hour could be maintained without inconvenience to passengers.

It has frequently been asked, could a person breathe going at that rate of speed? It is not necessary to say he could, as we are constantly traveling over 1,000 miles per hour, without suffering any inconvenience, as in either case the atmosphere is carried with us.

And again:—What would be the effect if a number of people were seated on one side of the car? Would it not throw it out of balance?

These narrow cars bring the weight of the passengers on one side within one foot of the center, the height being fifteen feet, the side strain overhead would be one-fifteenth of the weight of the highest number of passengers (36) possible to be seated on one side, and would only be about 75 pounds on each of the four overhead trolley wheels. This would only be a trifle, as they are constructed to carry from two to five tons weight. This is an extreme case, however, as the cars ordinarily would be about evenly balanced.

A DOUBLE TRACK ROAD OF EVERY SINGLE, AND A FOUR TRACK OF EVERY DOUBLE.

THE illustration on the opposite page shows how this is accomplished. On the side of the structure where the Bicycle trains are shown, we have an ordinary standard gauge, four feet eight and one-half inches. This gives us four feet and eleven inches from center to center of each rail, and as shown, with cars four feet wide, we have eleven inches between trains. This is ample.

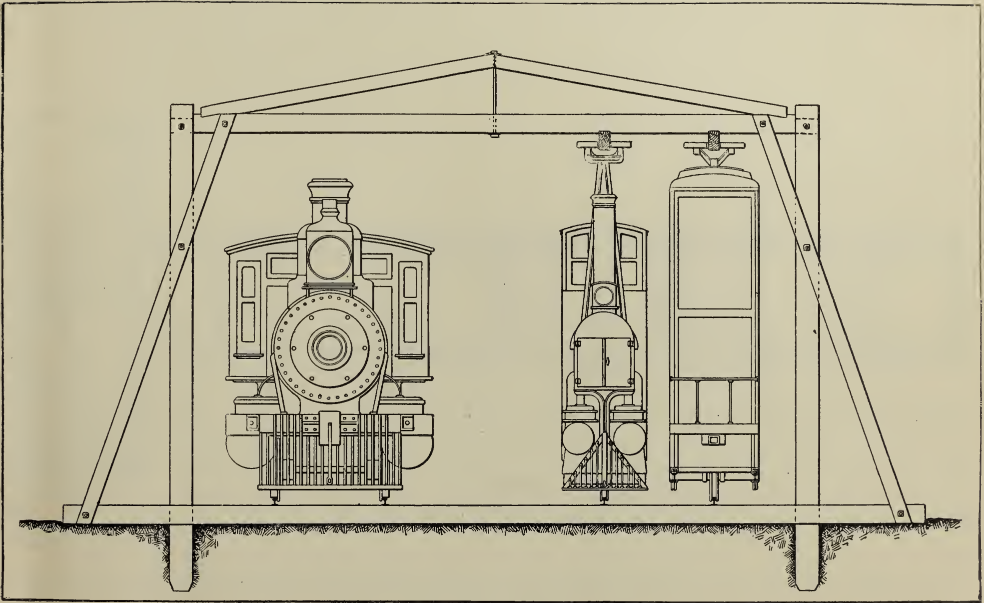
On places were the curvature is considerable, cars could be made still narrower to accommodate four in each compartment instead of six, and to allow more space to clear one another in rounding curves where the overhang is considerable.

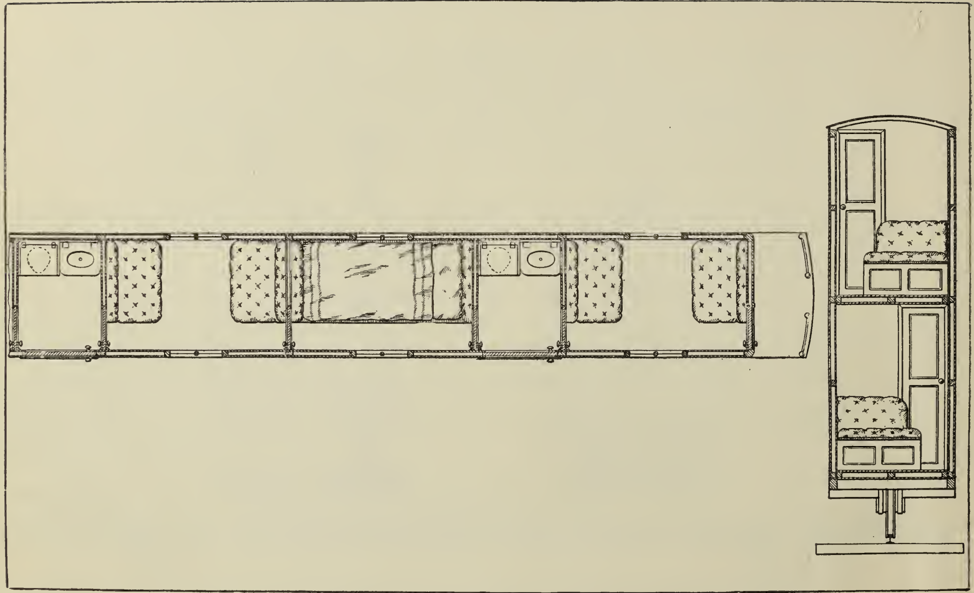
On such a road as shown here, two rails could be used for through express trains solely, with no possible interference, and every opportunity would be given for a very high rate of speed.

The value of such a line to business men would be incalculable, giving them a rapid, comfortable and safe transit, and at one-third the cost to railroad companies of the present so-called express trains.

Any business man, to whom time is valuable, would pay almost any price to reach the various places in order to facilitate his numerous business transactions.

The other two lines could be used for local passenger traffic and the carrying of freight.





Bicycle Palace Car.

COST AND ADVANTAGES OF UPPER STRUCTURE.

THE cost of changing an ordinary double-track road, with wooden structure similar to that illustrated on page 9, would depend on the price of timber in the locality where the change was to be made. A wooden structure would in many cases be sufficient, provided it were made of the proper strength, and would last a great many years with a very slight cost for repairs.

On these structures could also be carried the numerous telegraph and telephone wires, and with suitable wire on the sides would furnish fencing, which is necessary to keep the track clear from cattle and other obstructions.

It will be noticed that the cross timber, upon which the rail rests, is bolted to and forms a part of the upper structure, so that from no cause whatever could the rail settle, allowing the train to drop out, but in any case the structure and track must settle together. In a structure of this description, posts would be required to be set from twenty to thirty feet apart, and the longitudinal guide-beams would be trussed together, making them very stiff and strong.

It must always be borne in mind that the strain on these structures would be but slight, either on tangent or on curves, and yet the structure should have sufficient strength to keep the overhead guide-beams true, so that the supporting and the upper guide-rail both are in the same vertical plan.

According to the Bicycle principle, the Bicycle cars would be able to keep themselves in an upright position, while in motion, without any assistance of the upper guide-beam; but to quote the *Engineering News*, "Of course as stability depends on the existence of rapid forward motion, and that motion ceases at stations, and is liable to have to cease at any moment from accidental causes, provision must be continuously made by overhead rail and guide-wheels, or otherwise, for support in case of need. Otherwise if the vehicles stop, they will at once tip over. But a provision of this kind, which is only called into action in case of stoppage or sudden casualty, is one thing: an overhead rail which is continuously relied on for support is another and quite a different thing. In the latter case, the conditions might not be more favorable for smooth motion than on the ordinary double-track rail. In the former case, the top guiding-wheels need not be in contact with the overhead rail at all, except at stations, and hence there is much less necessity for exact construction or great strength or durability, and the evident possibility of maintaining much higher speed with smooth motion, because, the faster the speed the stronger should be the forces tending to maintain verticality, if the Bicycle principle be, in fact, capable of such extension, and the action of these forces is perfectly smooth and uniform."

After a year's constant use on the Coney Island road, with a wooden structure which was only put up for temporary use, the effect on the guide-beam was hardly perceptible. We have run on this road over 7,000 trips, or about 25,000 miles, and the rubber bands on the trolley wheels of the cars are not worn at all. These facts will bear investigation, and certainly ought to show conclusively the amount of overhead strain on the structure, as the road is full of sharp curves, and the effect of the strain should be apparent here if anywhere. Note Mr. Pond's letter.

"Hon. E. M. Boynton, President Bicycle Railway Co., 32 Nassau Street, N. Y.

"Dear Sir:—I wrote you on the allowance of patents on your Bicycle Railway System as follows:

"'It presents, I think, a practical solution of the problem of increased rate of speed, as also of the problem of an increase of the ratio of paying to non-paying load, whether in freight or in passenger traffic.'

"'I think both these results are altogether feasible, and are rendered so by the system you propose, which is simple, inexpensive and practical.'

"After my ride of Saturday last on your road, I will add, that I regard the predicted success as mechanically and practically accomplished. Upon careful examination, I believe the conditions to be more favorable to safety at a very high speed than in the standard road.

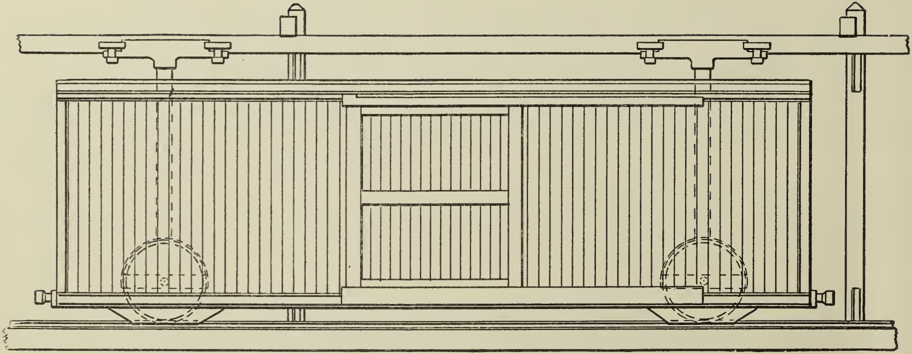
"The whole catalogue of risks arising from 'spreading' of the track is eliminated from railroading by this system.

"The freedom from lateral oscillation at high speed—at any speed—is remarkable, but very easily explained. Accustomed to write a great deal upon moving trains, I can write a steadier, smoother hand on this car than ever on any other. The evident capability of very high speed is surprising. Ride upon the tender and watch the guide-wheels aloft, and see for yourself how much the machine, when at high speed on a tangent, stands right up of itself, 'bicycle fashion,' and how little work is required of those same guide wheels; and, in short, to see the train pass is to see the 'poetry of motion.'

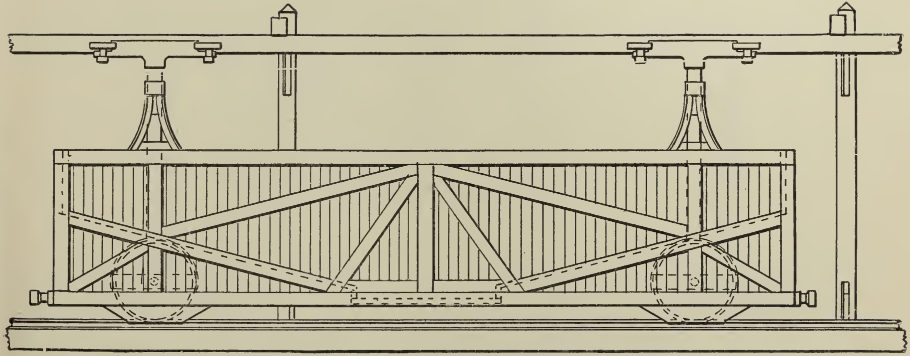
"It would seem that to run 100 trains, each of sufficient capacity to carry 100 persons a mile and three-quarters, all on half a ton of coal, should attract the sharp attention of railroad people. Such a fact admits of some astonishing deductions, but can probably be explained by the very great reduction of friction, and the reduction of non-paying weight per passenger to be hauled, from six to thirty fold, which are realized in your system. To be able withal to transform a single track standard road into a double track line, with more than a doubling of capacity, is another startling and very tempting fact. I see no reason why your system should not, and every reason why it should, be universally adopted by existing roads in the interest of speed, safety and economy.

"BENJ. W. POND, *Examiner U. S. Patent Office.*"

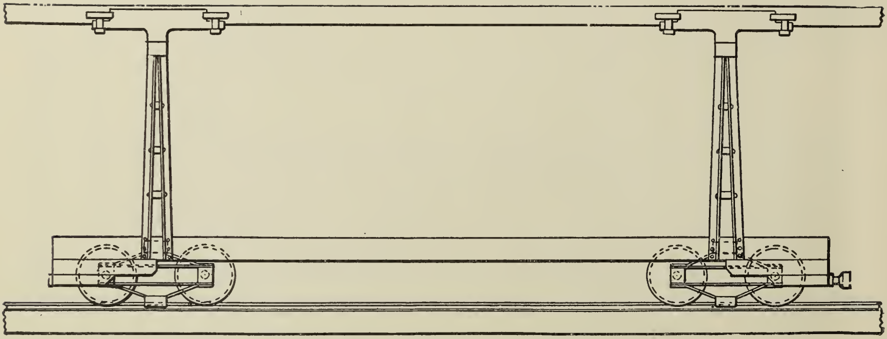
N. B.—Mr. Pond is and has been Chief Examiner in the Railway Department of Patents for twenty years past.



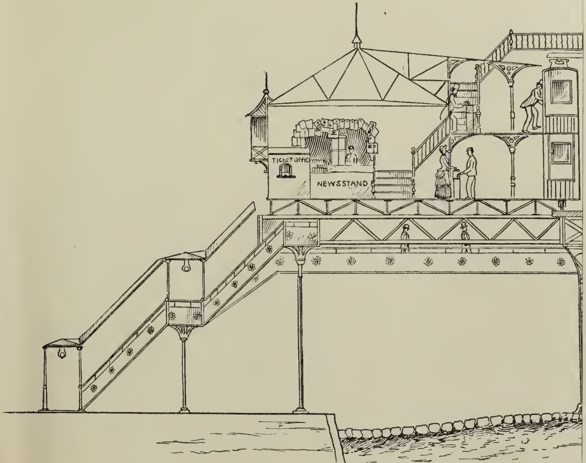
Bicycle Box Freight Car. 30 feet long. 5 feet wide. Weight, 3½ tons. 9 feet high. Capacity, 7 tons.



Bicycle Coal Car. 24 feet long. 5 feet wide. Weight, 3½ tons. Capacity, 7 tons.



Bicycle Flat Car. Length, 30 feet. Width, 5 feet. Weight, 3 tons. Capacity, 7 tons.



Elevated Railroad Station showing the l
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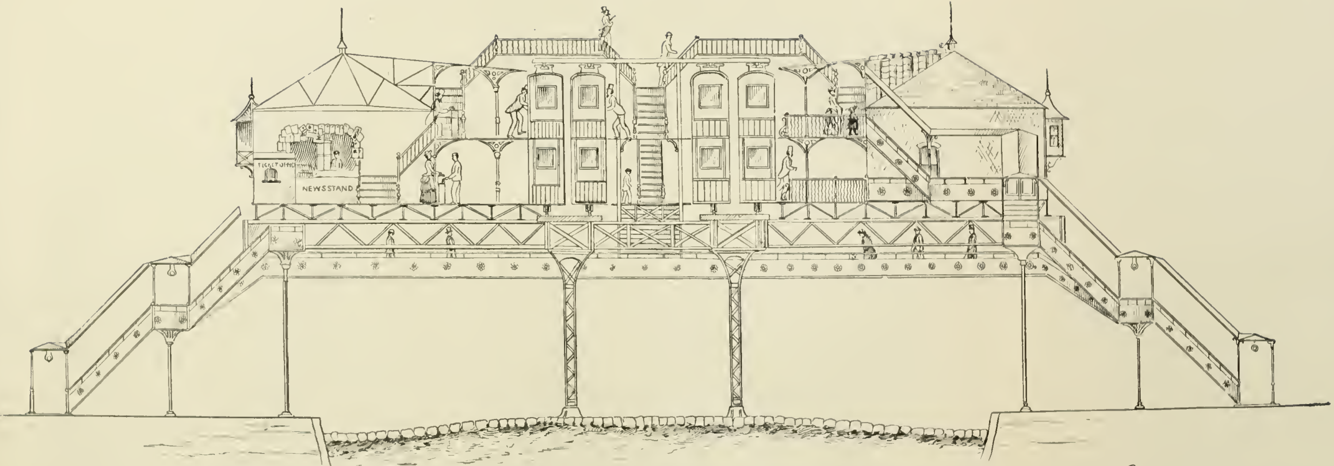


Elevated Railroad Station showing the two Express and the two Local Trains of the Boynton Bicycle System and the manner of getting in and out the trains from the lowest Stations. Where height is sufficient the entrance to the Express trains is made directly in an Elevator from the Street.

THE EFFECT OF WIND PRESSURE.

IN a recent scientific review, the writer, while admitting advantages of the Bicycle System under ordinary circumstances, says: "A high gale of wind striking against the sides of these two-story cars would press them against the upper rail with a force which nothing could resist." Our present location should have given this matter the severest possible test, located as we are in close proximity to the ocean and exposed on a trestle over a mile long and high above the level of the sea, where terrific gales of wind have swept against the sides of the cars. We have as yet had no difficulty in keeping the track, and have failed to perceive any signs of being carried away by this "irresistible force" of which he speaks; on the other hand, we would not answer for the safety of a standard gauge train passing over the same place under like conditions, as instances of locomotives being blown off the tracks and down embankments are authenticated. Certainly a gale of wind which is strong enough to endanger Bicycle cars or structures, would carry the heaviest standard gauge train off the track.

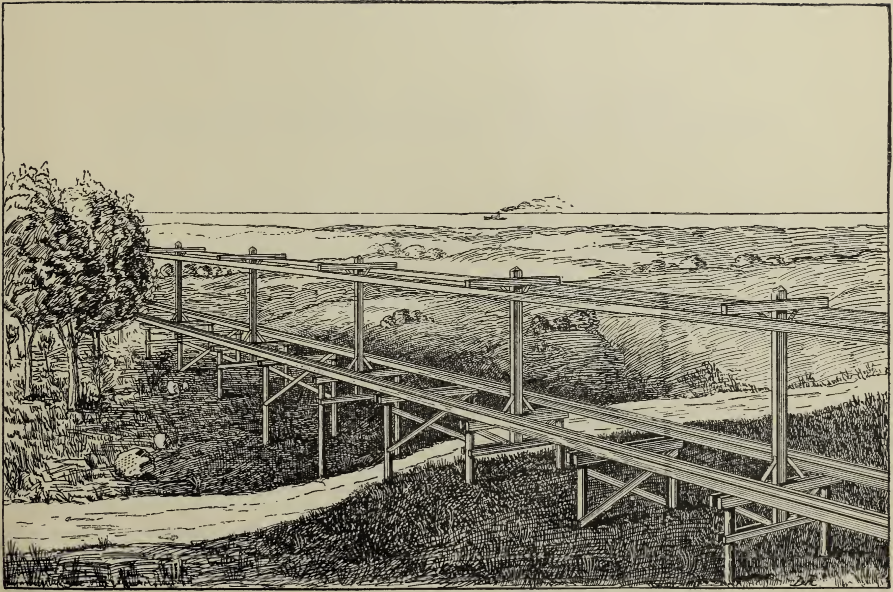
In the Bicycle System the trains as they pass along serve in a measure to ballast the structure at the very point where the wind pressure blowing against the sides of the cars would have any effect.

FARMERS AND CHEAP SUBURBAN ROADS.

THE possibilities of this system of railway construction are immense. Small feeding roads may be built in sparsely settled districts, where the farmer of moderate means may build his own roads, and transport his grain and produce to town with but a trifling cost. A road sufficient for this purpose could be built for probably about two thousand dollars per mile, especially in districts where timber is readily obtainable. This would be a great boon for farmers, as at present some of their products scarcely pay for raising, and their only means of transportation to the large towns is by horses and wagons.

A very light rail may be used in this description of railroad by placing longitudinal timber underneath, which could be formed by a tree hewn or sawed on one side for the rail to rest on. Passing underneath is the cross-timber placed at right angles, to the side of which supports for the upper structure are fastened. Bicycle locomotives may be constructed weighing from two tons up to any weight according to the load necessary to be drawn.

Where the surface is moderately level, longitudinal timbers may rest on the ground. From their strength and stiffness the danger from washouts would be very little. These structures may be composed of lighter or heavier timber, as it all depends upon the weight which they are required to carry.



Elevated Double Track Georgia Pine Structure. Cost, $20,000 per mile.

BICYCLE ROADS IN MOUNTAINOUS DISTRICTS.

THERE are numerous places where the Bicycle System will commend itself, and where the necessity for the construction of a standard gauge track becomes a very expensive operation, especially in mountainous districts, where solid granite must be cut away in order to get the required space. The actual space occupied on the surface for a Bicycle road, need only be enough to rest the supporting rail, where a standard gauge road would require a great deal of expensive work to prepare a level surface the necessary width, upon which to rest the ties. A longitudinal iron or wooden beam upon which to rest the rail is all that would be required for the Bicycle line, thus bridging all inequalities, and saving greatly in expense.

And in addition, the ease with which its cars and engines may turn, render it especially applicable to such places where sharp curves occur, in winding around mountain gorges. In such places the Bicycle road requires a space only four and one-half feet in width for a single line, and for a double line about nine. In putting up the structure the rock may be drilled, and slight iron supports fastened to it. Another advantage which is apparent in case heavy grades are to be mounted, is that an arrangement could be constructed, which, by pressing against the upper structure or overhead guiding-beam, would greatly increase traction.

Numerous narrow gauge roads now in operation in the West prove their advantage over the ordinary standard gauge, in the saving of friction and the ease with which they turn sharp curves. No narrower gauge road than the Bicycle can possibly be constructed, and, as narrowing the gauge decreases friction, surely we have the greatest possible advantage over anything yet constructed. Its economy and simplicity is very superior. You can never get less than a single wheel, or line of wheels, or less than a single rail to run upon.

COLLISIONS AND THEIR CAUSES.

RAILROAD statistics show that the cost of operating and maintaining the present through express trains is very great, as all other trains must be hurried through at a rate of speed that is neither wise nor economical, in order to reach some particular point where these trains may be sided to allow the passage of express trains. The result of all this is soon apparent on trains and road beds, entailing additional expense for repairs, to say nothing of the danger attending this system of dodging. It is estimated that from fifty to sixty per cent. of the accidents on railroads ensue from collisions, and this in spite of the most improved system of signaling, numerous dispatching stations, and facilities for sending messages by telegraph.

Collisions occur, not so much from the speed of express trains, but from the various rates of speed of the different trains. It is readily apparent that no collisions could occur where trains running in the same direction maintain a uniform rate of speed. This cannot be, however, and therefore, in order to facilitate transportation, more lines must be accessible to perform this with safety and economy.

With the Bicycle System this can be accomplished much cheaper than with any other, as we have shown. As certain as it is that it costs ten times as much to move ten tons as it does one ton, it is just as certain that a corresponding ratio of proportion between Bicycle and standard gauge trains must reduce the cost of operation ten-fold, as they are one-fifth the weight and twice the seating capacity. When this is taken into consideration, with the additional factor of safety, which is desirable above all else, surely the Bicycle System should be entitled to great consideration.

Aside from the question of speed and safety, this system should commend itself to all railway managers who have other than personal interests to serve, from the fact of the important bearing the question of economy has upon it.

It may be asked if it is really true that the trains may be run on this system so much cheaper than any other, and supposing the weight of trains are equal, could this high rate of speed be maintained? To this we say emphatically, yes! Two things must be borne in mind, however; first, that in order to carry weight at a high rate of speed, an additional expense must necessarily ensue, as much from the damage done on the road bed and wear on rolling stock, as the actual consumption of fuel. Second, the amount of gain, providing the weight of trains were equal, would be the actual friction saved by Bicycle trains, as we have shown, from the action of the single wheels on the rail. That this would be considerable will not be questioned, and yet this is not all, *Light cars may be run on this system at very high rates of speed with the greatest safety, and because they are light, with wonderful economy.*

May not cars of the same weight be run on standard gauge roads? It is impossible; as in running at any considerable rate of speed, they would inevitably leave the rail; and from the tendency to lateral motion, and also from the inequalities of the rail, they would be tossed up first on one side and then on the other. This danger would be greatly increased from a light construction.

Not so with the Bicycle trains. Supposing from the inequalities of the rail these cars should bound, from the fact of their having received a direct impelling motion in a vertical direction, they would not be thrown off, but would fall back squarely on the rail. This would be the natural tendency, but in order to prevent any possible chance of leaving the rail, the overhead structure is so gauged that the cars and locomotives cannot rise far enough to clear the flanges of the wheels.

The present standard gauge cars must be constructed heavier in order to stand the great strain resulting from their oscillating motion, and also from the fact that they are supported only from the base or platform of the car.

With the Bicycle cars it is entirely different, as they have two points of support, top and bottom, and their structure may be much lighter with safety.

So in summing up, we here present two all important factors which give us the greatest economy in railroad transportation, viz.: saving of friction with the Bicycle wheels and spindles, and the reduction of dead weight. Certainly every additional pound of weight drawn means a corresponding consumption of fuel.

The accompanying affidavit shows the coal consumption of the Bicycle engine No. 2, it having a traction sufficient to move two hundred persons in Bicycle cars, over a grade not exceeding one hundred feet to the mile.

"From August 23d to September 23d inclusive, we have furnished the entire coal consumed by the Boynton Bicycle Railway Company in running their engine No. 2 with train attached, their schedule including fifty trains daily, both ways, one hundred in all, over one and three-quarter miles of road. They have kept steam continuously and used some coal for other purposes, and the exact amount furnished and paid for in the ordinary course of business, with no previous notice to us, has been 31,000 pounds for as many days of continuous steaming in running trains with capacity of from one to three hundred passengers safely, successfully and at the highest rate of speed known.

"Henry Henjes, Bath Beach, N. Y.

"Sworn to before me this 30th day of September, 1890.

"George W. Wallace,
"Notary Public, New York County."

This proves that a train of similar capacity can be run from New York to Boston and back with a coal consumption of but one ton, where from fifteen to twenty tons are now consumed. A single Bicycle car has usually been used, containing seats for one hundred and eight people, and at short intervals on the middle of the road, this car has been run ninety miles per hour, with passengers on board. Having run seven thousand trains, connecting with other lines selling through tickets, the safety, economy, and unquestioned success of this System has been practically demonstrated. When we consider the enormous weight of a Pullman Palace car (from eighty to ninety thousand pounds), which is equivalent to the weight of seven hundred passengers, we question, why not carry the seven hundred passengers instead of their equivalent in unnecessary timber and iron.

The people of the United States have built and now sustain by their labor an investment of ten thousand million dollars, on which an average interest is paid of about double that of Government three per cent. bonds, and yet they cannot travel on these highways, constructed with such infinite toil and expense, unless they carry from ten to twenty-fold the weight of each passenger when the seats are filled.

The rapid Bicycle trains will supersede this slow, wasteful system. An average speed of sixty-five miles per hour will reach the Pacific coast from New York in two days. A speed of one hundred miles per hour is readily obtainable by steam or electricity on the Bicycle plan.

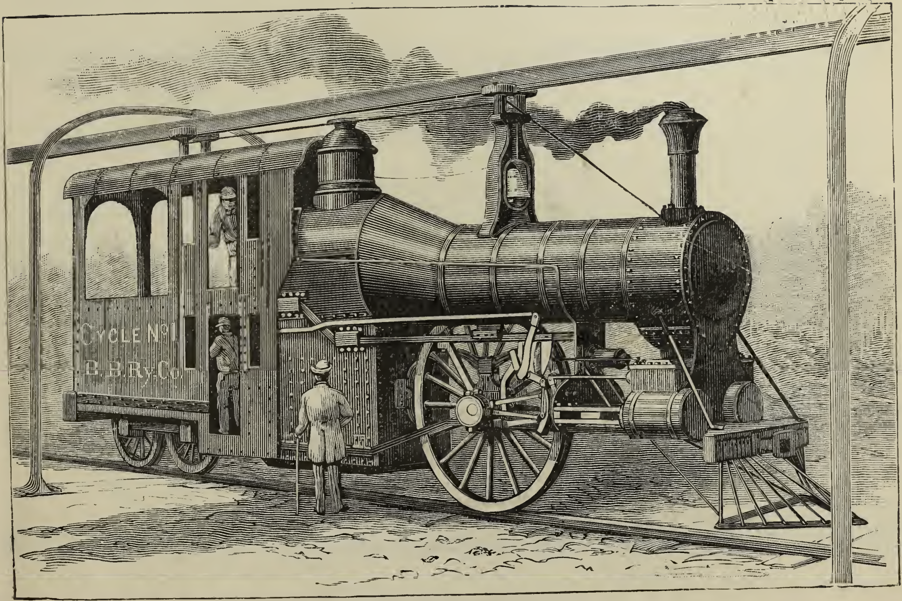
BICYCLE LOCOMOTIVE No. 1.

THE illustration on the opposite page describes our locomotive No. 1. It was built in Portland, Me., and is probably the first Bicycle locomotive ever constructed. At the first public trial, which took place in September, 1888, at Gravesend, L. I., were present some of the most prominent railroad men in the country. Its capabilities for speed were satisfactorily demonstrated, but owing to the shortness of the road, no especially high rate of speed was attained.

This machine weighs 23 tons. It has two 12x14 inch cylinders, and a driving-wheel 8 feet in diameter. It has a traction of about 300 tons. There is no doubt that this machine could easily maintain a speed of 100 miles an hour, drawing a train of Bicycle cars, with a seating capacity more than equal to that of the longest standard gauge train.

The steaming capacity of the boiler has been found to be very great, and entirely adequate to perform the work required of it. The extraordinary height of the fire-box, 6 feet from grade to crown sheet, forms a natural combustion chamber, causing great economy in the consumption of fuel.

This machine was found to be heavier than was necessary for the Coney Island road, and locomotive No. 2, a much lighter machine, is now used in its place.



Bicycle Locomotive No. 1.

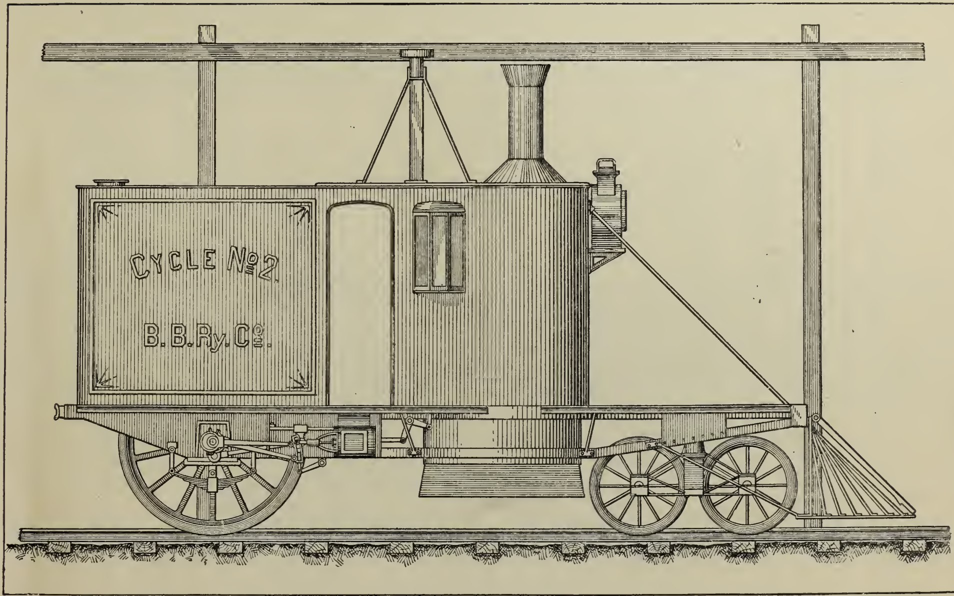
BICYCLE LOCOMOTIVE No. 2.

THIS locomotive was constructed at the same time as the No. 1, but not as an improvement over that machine, its principal advantage being that it was so much lighter in weight. This was particularly advantageous from the fact that we were using an old unused road not designed for heavy traffic, and with this light machine we could attain a much greater speed with safety on this limited road than with the No. 1. It weighs only nine tons, but by filling the tanks with coal and water the traction may be greatly increased. The driver is 6 feet in diameter. It has two cylinders 10x12 inches. The boiler is an upright containing 102 tubes.

This machine is capable of a speed of 90 miles an hour drawing three Bicycle cars, with seating accomodation for 300 people, and an average consumption of coal of one-half a ton per day.*

We have used this locomotive constantly since the 16th of August, 1890, and have made the regular run of the road, one and three-quarter miles, in three minutes regularly. On special time trips, the same distance, in two and a quarter minutes, including starting and stopping.

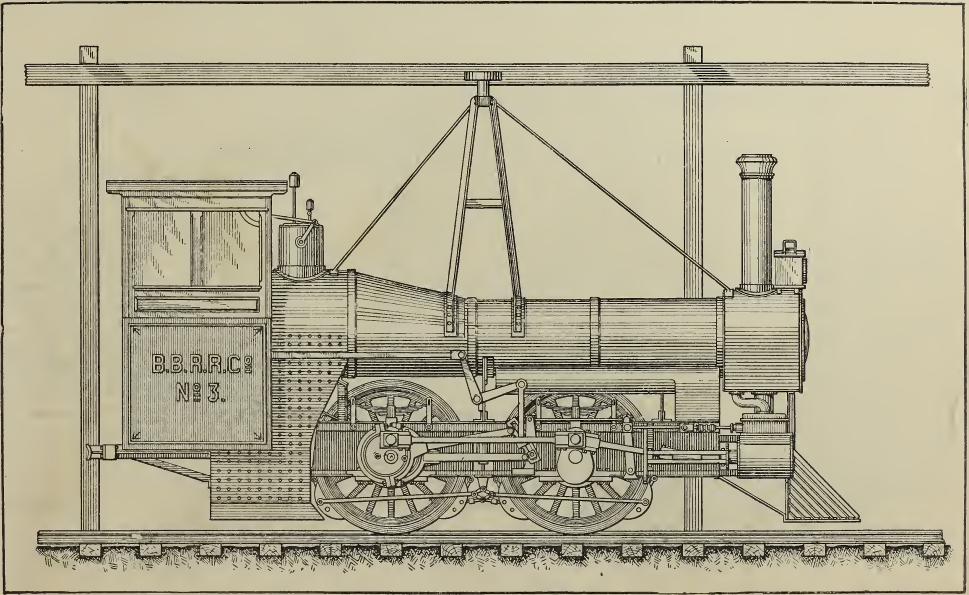
*Note on page 23 sworn statement of Henry Henjes, coal dealer.



Bicycle Locomotive No. 2.

BICYCLE LOCOMOTIVE No. 3.

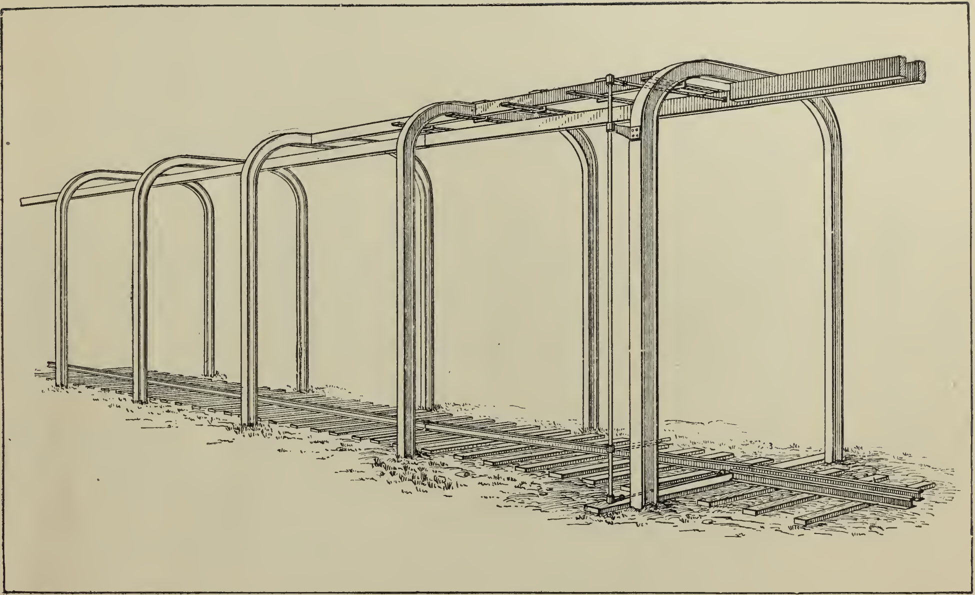
THIS machine is the most perfect yet designed by us for a Bicycle locomotive. Weight, 16 tons, traction, 400 tons. The cylinders are the same size as those of No. 1, 12 x 14 inches. Diameter of drivers five feet. The crank is only 7 inches in length, so that 600 revolutions per minute may readily be obtained. There is no doubt that this locomotive can easily maintain a speed of 100 miles per hour drawing ten Bicycle cars, seating 1,000 passengers and weighing about 125 tons. This is more than the longest train on the standard gauge now accommodates. This machine is under construction, and we have full and complete working drawings of every detail, and every improvement designed equal to the most modern locomotives.



Bicycle Locomotive No. 3.

SWITCHES FOR THE BICYCLE SYSTEM.

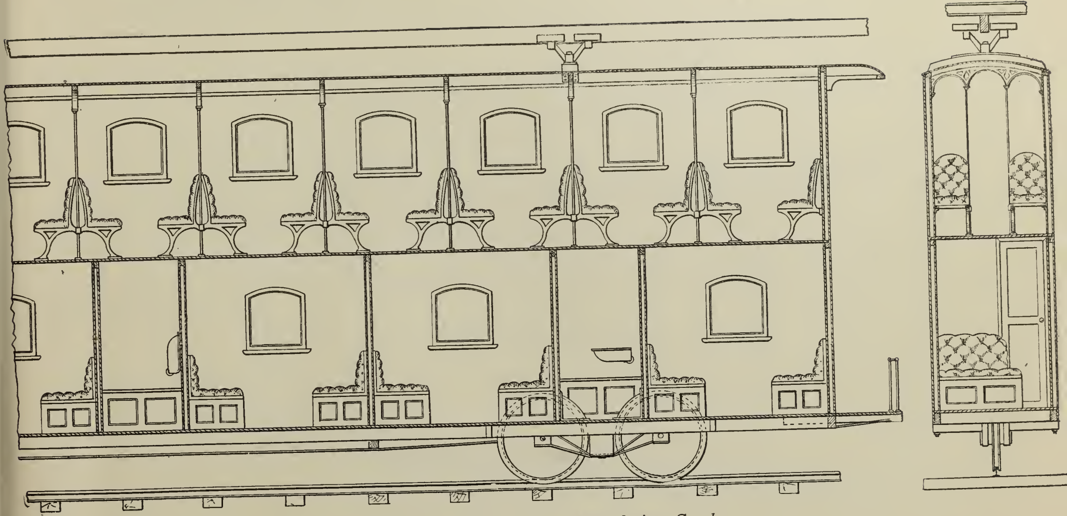
ON page 31 we give an illustration of our switches. The standing vertical bar reaches from the tie or road-bed to the top of upper structure, with a crank top and bottom, thus operating top guide-beam and lower rail simultaneously. When full throw of the switch is made, the ends of the rail and guide-beam are brought directly opposite, making the joints similar to the old stub switch. These switches are thrown and locked the same as those now used. The length of the shifting guide-beam and lower rail is thirty feet. The swing of the guide-beam is eighteen inches, while that of the rail is about six. The difference between the two, twelve inches, gives the tilt to the car which facilitates the switching of cars or locomotives, leaning them to the right or left, thus reducing friction. We have two in use on our Coney Island road and have had no difficulty in switching our heaviest locomotive. Indeed the matter of switching *only appears* to be complicated, whereas, in fact, it is very simple and safe. No contingency can possibly arise where these cars and locomotives could not be switched.



Bicycle Railway Switch.

BICYCLE SLEEPING AND ACCOMMODATION COACH.

THE illustration on page 33 describes the Bicycle sleeping and accommodation coach. The upper story is furnished with upholstered seats for thirty-six people. The lower floor has six sleeping apartments containing berths thirty-six inches wide. There are also three toilet rooms, one between each two compartments. The upper story is furnished with a door at each end of the car, which is reached by means of a spiral stair case from the lower car platform. In the lower story the doors are arranged on the sides of the car opposite each compartment and toilet room. The passengers may enter the compartment directly from the sides or through the toilet room. Every arrangement for comfort and convenience of passengers is designed for these cars.



Bicycle Sleeping and Accommodation Coach.

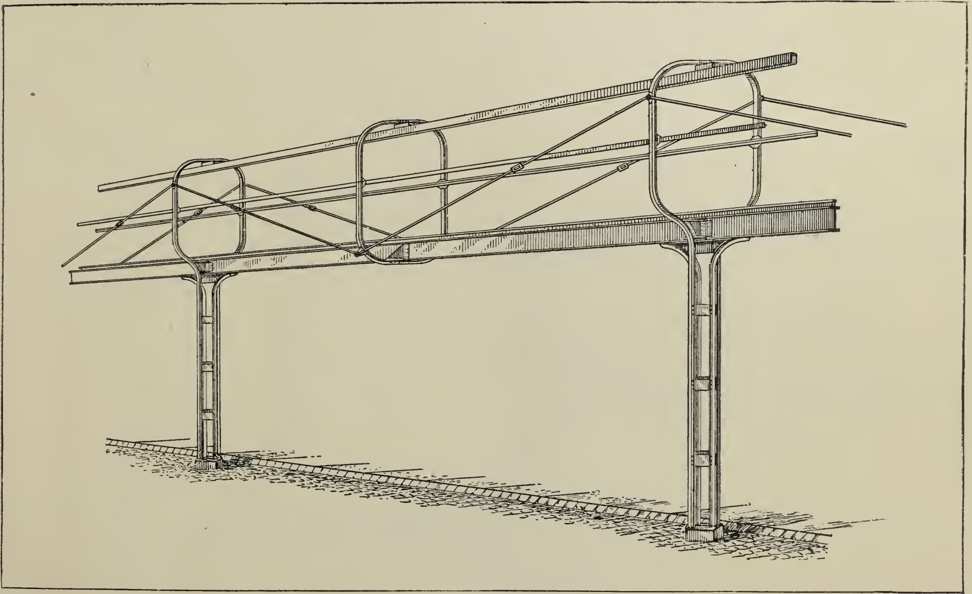
BICYCLE SYSTEM IN CONNECTION WITH ELEVATED ROADS.

IN addition to the apparent advantages of the Bicycle System over all other surface roads, it is peculiarly adapted to elevated roads in cities and suburbs. First, from the fact that a single line of rails is used, it is not necessary to cover up a street entirely, thus blocking it up from daylight, as is now done in a great many places, but Bicycle structures may be built as shown on page 35, where posts are set at curbs on each side of the street, forming little or no obstruction to light.

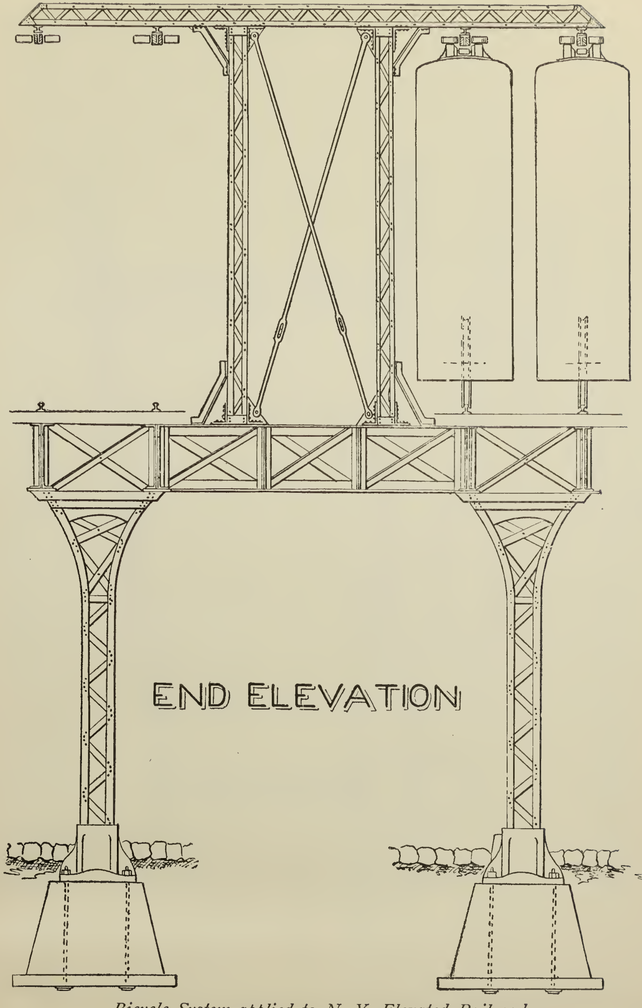
Anything which tends to darken streets in front of property tends in a measure to depreciate the value of that property, as stores and apartments will certainly not rent as readily as those which have the full advantage of daylight. Of course the facilities of transportation to the different localities make up in a degree for this deprivation, but, if the same end can be reached, and even greater means of transport, without this nuisance in our streets, can be attained with the Bicycle System, it should certainly be entitled to an impartial consideration.

The Bicycle trains having one-third the weight of those now operated, will make less noise in rolling on the rails, and as the power exerted to move them will be two-thirds less, there will be a corresponding reduction in the noise of the exhaust.

Two Bicycle trains can be run on one set of posts, leaving ample room to pass each other, and they could also be run as shown on page 45, on posts placed in the middle of the street with scarcely any obstruction as far as light is concerned. Another enormous advantage is the economy with which the Bicycle structures can be built. A Bicycle structure sufficient to accommodate two lines can be built for one-fifth of the cost of the present elevated structures in New York City and Brooklyn. There should be something in the foregoing facts which should set our railroad projectors thinking. The numerous advantages and tempting possibilities of this system should cause its early adoption. Even the present elevated cars, which are comparatively light, are entirely too heavy, and only increase the cost of their operation. Bicycle cars have been built weighing only five tons, with a seating capacity for 108 people, more than twice the number these cars will seat. One-story Bicycle cars may be built weighing about three and one-half tons and seating 54 people. These are facts, not theories. If we must use elevated roads in our cities, why should we load them with unnecessary weight, entailing an expenditure of enormous sums for iron structures heavy enough to bear their weight, when this can largely be avoided.

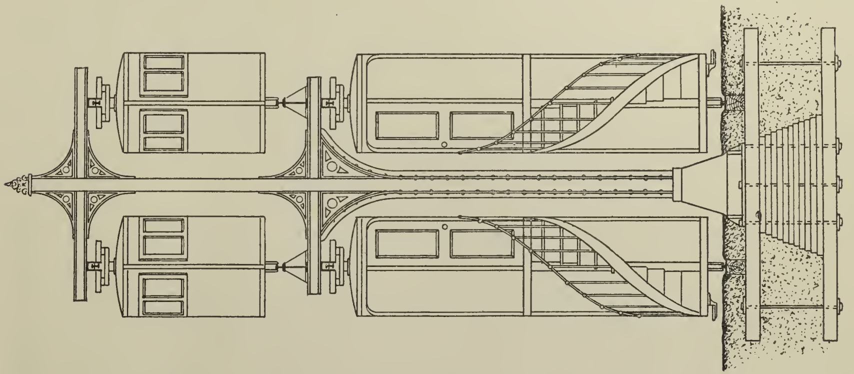


Single Bicycle Elevated Structure.



Bicycle System applied to N. Y. Elevated Railroad.

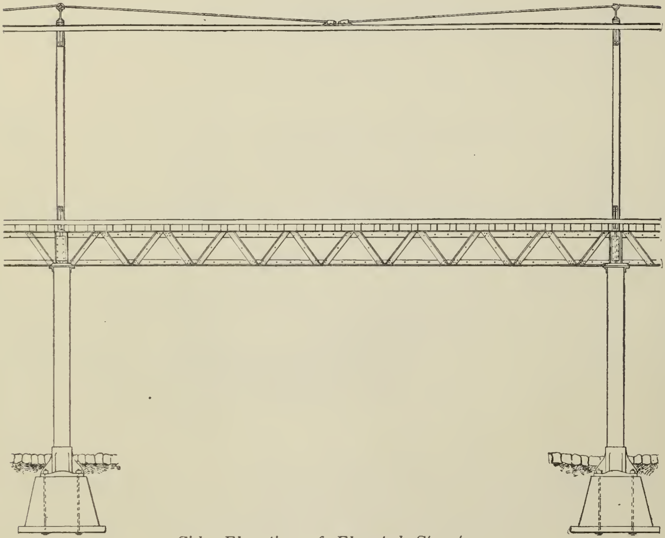
What can be done with the present elevated structures in order to secure rapid transit? Many schemes have been advocated, but none so far which are practical, except through the expenditure of about $50,000,000. The nearest approach to rapid transit we have yet attained is an average speed of ten miles an hour, and there are some hours in the morning, and at night, when not even half the people can be seated, but the balance are packed in like sardines in a box, obliged to stand up and hang on to straps for from one-half to three-quarters of an hour, instead of receiving the accommodation for which they pay. Real rapid transit can be obtained but in one way.



Combined Elevated and Surface Structure.

Two more lines must be accessible for express trains. The Bicycle System will give these two extra lines without change of gauge, and give four trains to the present two, with only the additional cost of the upper structure. Illustration on page 36 shows how this may be accomplished. The elevated structure would then have much less weight to carry, and this change could be made without interfering with the operation of the present trains. A great many people who ride on the elevated roads have ridden in the Bicycle cars on the Sea Beach and Brighton Road at Coney Island, and can testify to the advantages of this system.

Another decided advantage in the Bicycle cars is their convenience in receiving and discharging passengers, the doors, 36 in all, allowing instant exit. A car filled with 108 people can be emptied in a few seconds There is no need for argument to show that 36 doors will allow emptying and filling more quickly than two. The difficulty of emptying a car quickly, containing 80 or 90 people, and obliging them to file through an aisle, is well understood, as we have all tried it, to say nothing of the inconvenience of pushing one's way through a car, packed with standing crowds, in order to get out at the desired station. The delay at stations to allow entrance and exit is no inconsiderable obstacle to the desired rapid transit, as the time consumed is, on an average, nearly what it takes to run from station to station.



Side Elevation of Elevated Structure.

The Bicycle cars will obviate this difficulty, giving every opportunity for the saving of time at the stations, which in making 40 or 50 stops is considerable. The income of the elevated railways may be greatly increased and the expenses decreased, and at the same time give the public the much talked of and desired rapid transit. There is every reason to believe that the Bicycle express trains could average 40 miles per hour on the elevated railroad, making only the most important stops, while local trains could more than double the present average rate of speed.

ELECTRICITY APPLIED TO THE BICYCLE SYSTEM.

IN addition to the numerous advantages of the Bicycle System over all others, the substitution of electricity for steam will greatly increase these advantages, and will show beyond a possibility of doubt that this system is especially adapted for the utilization of this motive force, more than any other known.

The first, and perhaps the most important point in its favor, is the use of the overhead guide in which to enclose the electric conductor. The advantages of this combination need hardly be specified, as they are evident to any one conversant with the transmission of electric energy. One of the many difficulties inseparable from the present overhead trolley system, is the proper insulation of the conductor, as it must expose a metallic surface for the transmission of the current from the conductor to the trolley, and must evidently be left without any insulating cover whatever. It is therefore not only at the mercy of anything that may come in contact with it, but is a constant menace to the safety of the public, as many cases show, where accidents have resulted from telegraph wires coming in contact with electric power wires. The

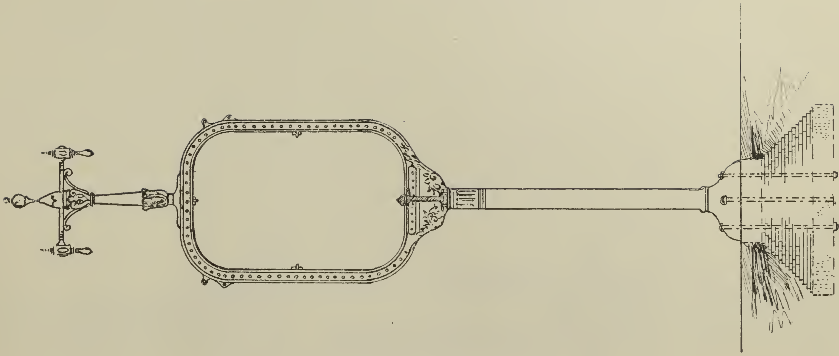
Bicycle Electric Car "Rocket," at Bellport, L. I.

use of guard wires, to prevent these contacts, only partially obviates the difficulty, and certainly does not tend to make the overhead trolley system popular. As the conductor is bare, it is exposed to all the evils arising from climatic changes, such as ice, snow and rain, and the difficulties under such circumstances to insure a proper insulation from points of support are very great, as at these points the presence of ice or other substances often causes a leakage of current.

Another difficult point is always to make contact with the conductor, as the latter is only supported at points some distance apart and between these points is loose and yielding, and therefore not always a reliable medium for tapping the current; the contact is not continuous, to say nothing of the liability of the trolley leaving it entirely. In forming curves, as the wire can only be extended in a straight line from point to point, it necessarily demands a large and unsightly network of wires; but even with this additional help to form the curves, it is impossible to pass these places at any rate of speed except a comparatively slow one, on account of the tendency of the trolley to leave the wire.

These are some of the evils attending the electric trolley system, which are entirely obviated by the use of electricity with the Bicycle System. Here the conductor is safely imbedded in the overhead guide, surrounded on all sides, except the lower, with insulating material, and leaving only a narrow slot at the bottom of the guide-beam, through which the trolley enters and makes contact with the conductor. The conductor of course conforms to the curves of the guide-beam, and is therefore safely and rigidly supported, without any motion whatever in any direction; it being encased on top and sides, is entirely protected from climatic changes and must always remain dry and clean. It is also evident that it is absolutely impossible to make any accidental contact with any other conductor, or vice versa, or to imperil the lives of the public in any possible manner. The conductor having a continuous support, and always being parallel with the supporting rail, a safe contact under high rates of speed is insured, and as the guide-beam holding the conductor is readily bent to conform to the curves, all difficulty in forming or rounding curves is eliminated. The slot in the guide-beam forms a moderately deep groove, making it impossible for the trolley to get out, or to leave the conductor.* Another advantage of the Bicycle System is the proximity of the car top and upper guide, which necessitates only a very short trolley arm instead of the long and cumbersome one now in use, with its large momentum, and consequent impossibility of running at any considerable rate of speed. As the conductor is so safely insulated, it will certainly permit the transmission of a much higher voltage, with its many advantages, without the risks to which the present electric roads are subject.

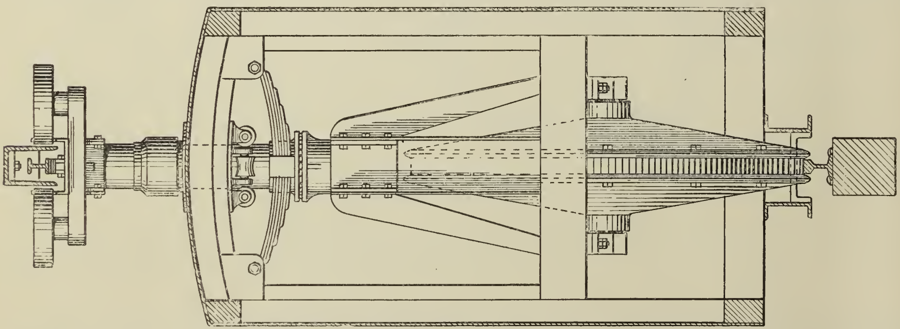
* That these advantages have also been acknowledged by electricians of repute, was shown at a recent meeting of "The Boston Society of American Engineers." In answer to a question of where to put the wires, Capt. Griffin said: "There are several suggestions made in reference to that. Mr. E. Moody Boynton's Bicycle Railway is especially adapted to electrical purposes." He then goes on describing and explaining the reasons for this.



Single Electric Bicycle Structure.

The foregoing are some of the many advantages which directly result from the use of the Bicycle System, but there are others which result indirectly, and are perhaps fully as important.

The difficulty with the present car motor is, that the power necessary to round sharp curves must be so much greater at these curves than on a straight line, due to the width of gauge, and consequent grinding and wedging, as well as the large rolling friction, that the motor must be constructed heavy and powerful enough to answer the purpose in either case. The advantages of the Bicycle System in rounding curves, and reduced rolling friction, have been described in former pages, and it should be very evident that a much lighter motor can be constructed, and with light Bicycle Needle cars, will give a speed greater than anything yet attained. Another disadvantage of the present heavy cars and motors, is the necessity of gearing the motor down to get power enough to start the car without burning the armature out. The motor of our new electric locomotive contains but a single stationary shaft, with the armature and wheel revolving on same, and in addition revolvable about a vertical axis enabling it to round curves. This supersedes the intermediate shafts of the present gear motors, whose friction and liability to breakdowns render high speed impos-



Sectional View of Bicycle Motor Car, showing Safety Shoe at Bottom of Car. Also Method of Suspending Car from Springs at top of Motor Frame.

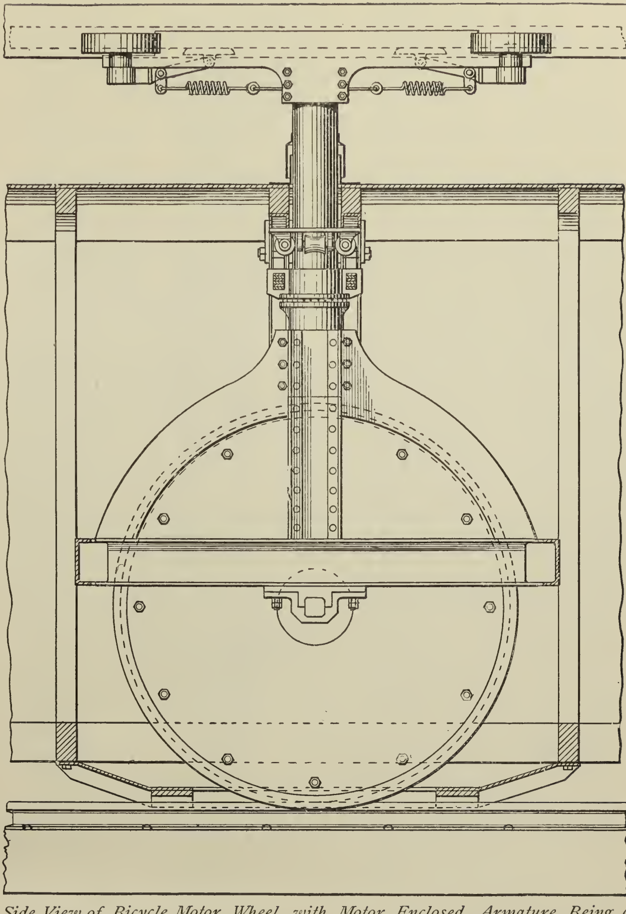
sible. The Bicycle cars running so much easier, permit the coupling of the armature directly with the driving-shaft without the necessity of intermediate gearing and all the evils connected with it. As the motor is in the car itself, it is entirely free from all the dust and dirt to which those now used are exposed, and every part is constantly in full view, and within easy reach of the engineer. Anyone conversant with the difficulties of supervising the present car motor and keeping them clean and well regulated, will fully appreciate the benefits derived from this alone. It is obvious that the outgoing and incoming currents could be sent through separate conductors in the overhead guide-beams, or if preferable, the return current can be sent through the supporting rail.

Each car has its own motor, and is therefore entirely independent, thus facilitating switching or changing from one track to another; it will also be possible to have the trains of almost any length, as each car furnishes its own traction and as a greater number of passengers increases its traction, no adding of dead weight is necessary. With one locomotive pulling a long train it is entirely different, as the adding of a number of cars is counteracting the traction of the former, and must be equalized by a corresponding weight of the locomotive, thus furnishing a dead load of no benefit, and besides, necessitating an increased motive force. In making up a train of these independent car motors, flexible electric connections will enable the engineer in the front car to control all the motors, and thus operate the whole train.

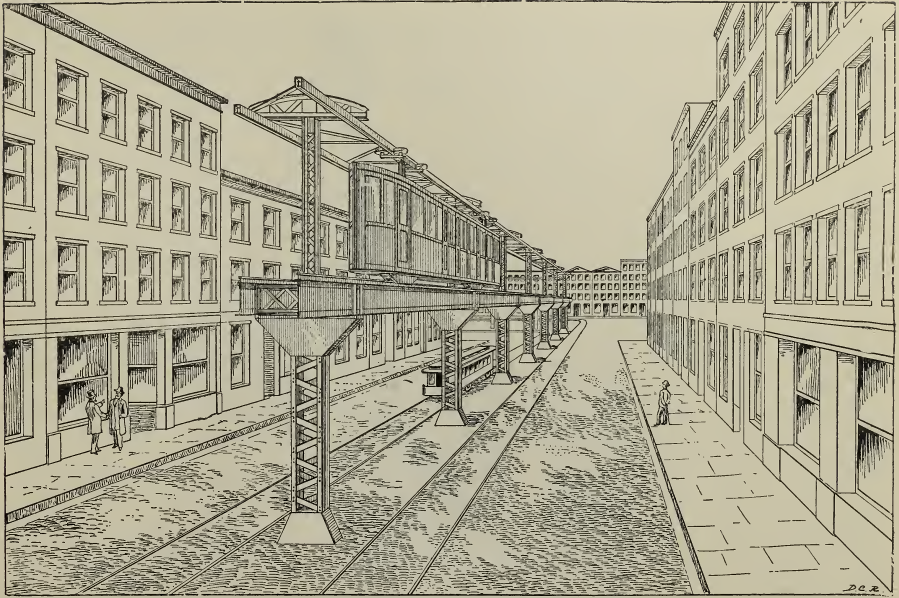
Illustration on page 45 describes the Bicycle electric car and the structure for an electric elevated road. The weight of car and motor combined will only be about six tons. With this combination it is possible to maintain a very high rate of speed. Certainly, without exceeding the number of revolutions already attained by electric motors, one hundred and fifty miles an hour would be feasible. Experts have expressed the opinion that electricity is the coming motive power. If this be a fact, as some of the recent electrical experiments seem to indicate, some system should be used which in all cases would be entirely safe, as the public will certainly not patronize any which would imperil their lives or property.

The cars are furnished with a grooved metal keel at each end, inside of which the wheels are revolving, so that, if from any possible cause one of the latter should break, the car would only drop far enough to allow this groove to slide on the rail, but would not allow the guide-wheels to leave the overhead guide-beam.

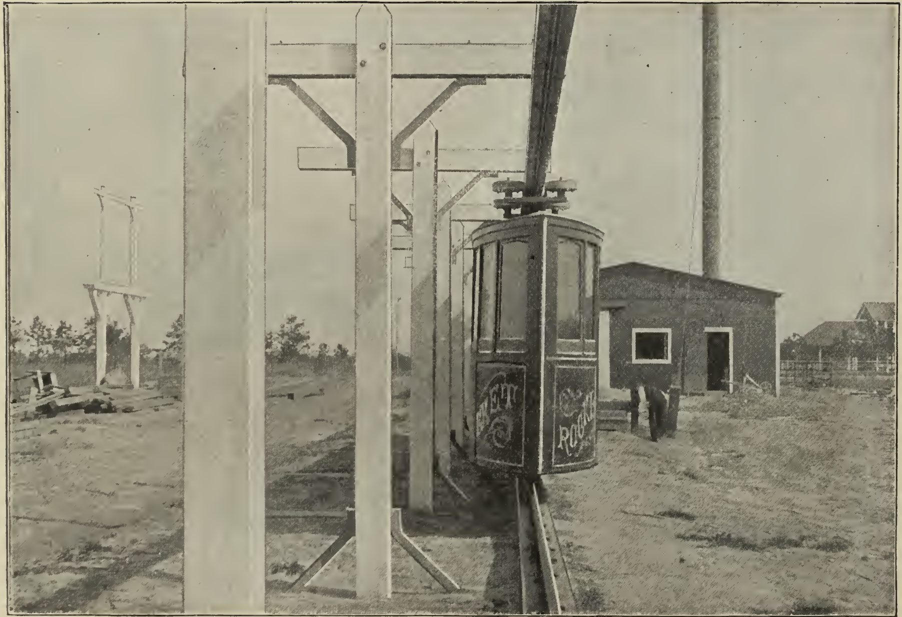
Now, in regard to collisions, which are apt to occur from many causes, even where a separate line is furnished for outgoing and incoming trains, unless some means are furnished to make such a contingency impossible. There is an electric system at present in practical operation in Austria, where in case trains approach one another too near for safety, a bell is set ringing in the engineer's cab of the train following, which warns him of danger, and continues to ring until a safe distance between the trains is established. A dial may also be arranged in the engineer's cab, which will show the position of every train and their relative distance from one another. Either one of these plans would remove all possibility of collision.



Side View of Bicycle Motor Wheel, with Motor Enclosed, Armature Being a Part of the Wheel. Also Detail of Trolley Shoes, Showing Method of Taking Current from the Conductor.



Single Post, Double Track, Steel Elevated Bicycle Structure, for Use in Streets in Villages and Cities.
Cost, per mile, $65,000.



Front View of Motor Car "Rocket," at Bellport, L. I., Showing Power Station and Structure of Railroad.

WHAT IS SAID OF IT BY ELECTRICAL AND ENGINEERING EXPERTS.

Kings County Elevated Railway Co.,
346 Fulton Street, Brooklyn, N. Y.

Hon. E. M. Boynton, Prest. Boynton Bicycle Railway Co., 32 Nassau Street, N. Y.

Dear Sir:—I have taken great pleasure in visiting and riding on your Electric Railway at Bellport, L. I. I was more than satisfied in regard to its feasibility and adaptability to quick transportation. By your single rail and narrow cars you have lightened many-fold the weight of trains, and enlarged proportionally the carrying capacity over steam roads, as at present existing, as you make a double-track road out of a single-standard gauge track.

I am fully satisfied as to its economical construction and working, its quick and rapid means of transit, and its absolute safety in transporting passengers and freight.

I see no reason why it should not be universally adopted, as the tests of both the steam and electric methods have proved its practical success.

Very respectfully yours,

O. F. BALSTON, *Chief Engr. K. C. El. Ry.*

(*Special despatch to the Associated Press.*)

New York, April 4, 1895.—A committee composed of members of the Senate and House of the Massachusetts Legislature to-day inspected the Boynton Bicycle Electric Road from Patchogue to Bellport, Long Island. The party entered a train at Patchogue at about noon, and shortly afterward were traveling around sharp curves and up steep grades at the rate of nearly a mile a minute, almost totally unconscious of the rapid rate at which they were going.

The results of to-day's examination are thus summarized by a member of the committee: First, they are satisfied the system saves half the weight per passenger carried; second, makes one rail do more work than two now do; third, gives double the speed possible by any other system; fourth, is about one-quarter the expense to build, as compared with elevated railroads; fifth, is perfectly safe, silent, dustless and doing double the work at half the usual cost.

The committee seemed especially delighted with the capability of the road in giving a double track on a single post, thus solving the question of rapid transit in the narrow streets of Boston and its suburbs, where several charters are pending. The visitors agreed that the Bicycle System was safe and less injurious to property than the trolley system.

MANHATTAN RAILWAY COMPANY, CHIEF ENGINEER'S OFFICE,
71 BROADWAY, NEW YORK.

DEAR SIR :—In regard to your request for an expression of opinion in relation to the practicability of the Boynton Bicycle Railway, I have to say, that I think the system is thoroughly practicable ; that the rolling stock can be economically constructed, and much lighter per live load carried than the ordinary rolling stock of equal strength.

By reason of the center of gravity coming directly over the single supporting rail, there will not be that disagreeable oscillation which takes place on the double-rail system, and which is so destructive to the rolling stock ; and for this reason a high rate of speed can be maintained with greater safety than on the present system.

Yours truly, J. WATERHOUSE, *Chief Engineer.*

Hon. E. Moody Boynton, President Boynton Bicycle Railway Company :

In the difficult road at Coney Island, and with its sharp grades and curves, where you have for two seasons passed one Bicycle steam train by another, thus making a double track of the standard gauge road, and wherein the running of ten thousand trains and the safe carriage of passengers, without accident, at high speed, with great smoothness and economy, have been accomplished, you have demonstrated your system to be perfectly feasible.

I have no interest in your Company other than as an engineer, but am pleased to give my impression concerning your road at Coney Island, as your success there has been very remarkable.

Yours truly, F. S. PEARSON,
Consulting Engineer, 81 Milk Street, Boston.

Mr. F. S. Pearson was Chief and Electrical Engineer of the West End Street Railway, Boston ; of the Brooklyn City Railway ; New York City, Jersey City, and many other roads.

PHILADELPHIA, PA., May 4th, 1895.

Hon. E. M. Boynton, Prest. Boynton Bicycle Railway Co., New York, N. Y.

DEAR SIR :—In reply to your letter of the 3d inst., requesting our opinion as to the merits of the Boynton Bicycle Railroad System, we beg leave to say that we believe the system possesses marked features of merit on the following grounds :

First; that a Bicycle railroad car, loaded with passengers, is much lighter than a loaded car of the same passenger accommodation of the present type, and consequently possesses corresponding economy in the power required to drive it at a given rate of speed.

Second; that owing to the lightness of construction, electric motive power, sufficient for the attainment of high speeds. can be applied to each car as an independent unit, instead of requiring a special electric or steam locomotive to haul one or more cars, thus obtaining for high speed railroads all the flexibility and advantages of the trolley system, as now employed in street passenger railroads.

Third; cheapness in the construction of the car, the roadbed and track, particularly when electric locomotion is employed, requiring an overhead structure.

Fourth; the advantage possessed by your system, in changing over from the present steam road to the Bicycle road, arising from the width of your car, which permits two cars to pass each other, on the ordinary 4′–8½″ track, thus providing a double track road in the space now occupied for a single track.

Yours respectfully, EDWIN J. HOUSTON.
A. E. KENNELLY.

HEADQUARTERS DEPT. OF THE EAST,
GOVERNOR'S ISLAND, N. Y.

My attention was first called to the Bicycle Railroad System, as developed by E. Moody Boynton, some two or three years ago, and I have since, from a careful examination of its workings, satisfied myself of its superiority in several respects to other methods of transportation. Its simplicity of construction and cheapness of operation have commended it to my favorable consideration, and the running of the experimental trains at Coney Island, and Bellport, L. I., the former by steam and the latter by electricity, have convinced me that its advantages are many fold.

The liability of accident appears to be at a minimum, and the questions connected with the cheapness of construction, the economy in operation, the great speed of trains, and the comfort and safety of travel, appear to be entirely solved by the employment of the Bicycle system.

O. O. HOWARD, *Major-General U. S. Army.*

ADDENDUM.

THE BOYNTON BICYCLE RAILWAY COMPANY is incorporated to license the use of its patents to all steam and electric railway companies, in the United States and other countries, on the payment of a small royalty.

All stock of the Company is fully paid by patents and property, is non-assessable, and it is not intended to incur any bonded indebtedness.

Any company organized for the purpose of using this system will pay a royalty of one-twentieth of the stock, or, if bonds are issued, one-twentieth of the bonds, as a full and final payment for the use of all patents issued or to be issued.

The running of over 17,000 miles by steam on the Coney Island road, and of over 8,000 miles by electricity on the Bellport road has demonstrated the complete mechanical and practical success of this system.

A saving of from six to twenty-fold is made in train weight for conveying passengers, and four-fold saving in conveying freight.

The Company will furnish on application any further information that may be necessary, to such railroad companies, or others, who desire to investigate this system, with a view to its adoption.

To those who may decide to use this system we will send full working drawings, which will enable them to construct cars, locomotives and structures.

THE BOYNTON BICYCLE RAILWAY COMPANY,
Room 615, 32 Nassau Street,
New York City, N. Y.

Directors of the Boynton Bicycle Railway Company for 1896.

Dr. James B. Bell, ...	Boston, Mass.
Maj.-Gen. O. O. Howard, ...	New York.
Geo. Haseltine, ...	" "
Geo. H. Gale, ...	" "
Eben M. Boynton, ...	" "
William A. Stevens, ...	" "
David Wallace, ...	" "
William H. Boynton, ...	" "
Francis W. Breed, ...	Lynn, Mass.
D: C. Reusch, ...	New York.
Geo. A. Bruce, ...	Summerville, Mass.
H. H. Mawhinney, ...	Boston, Mass.
E. L. Sanborn, ...	" "
Wm. H. H. Hart, ...	San Francisco, Cal.
William H. Thurber, ...	Providence, R. I.
W. E. Scarritt, ...	New York.